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METHOD FOR THE MANUFACTURE OF ICE DESSERT

Claim

1. A method for the manufacture of ice dessert having a soft texture at low temperature, characterised in that, a frozen dessert which is once frozen is compressed under high pressure.

Detailed Description of the Invention

The present invention relates to a method for the manufacture of an ice dessert and, more particularly, it relates to a novel method for the manufacture of ice dessert having smooth palatability and soft texture which have not been available in the conventional ice dessert, characterised in that, an ice dessert which is once frozen is compressed under high pressure whereby an ice crystal structure having the directivity is destructed.

Ice dessert, ice lolly and the like are usually manufactured, for example, by an ice dessert manufacturing method by dipping in a refrigerant where a mix where milk product, fruit juice, emulsifier, stabiliser, colouring agent, fragrance, acidifying agent, etc. are mixed and sterilised is filled in a container having a predetermined shape (or, in other word, an ice tube) and frozen by dipping in a refrigerant liquid. However, in the ice dessert manufactured as such, it is unavoidable that the ice crystal structure of the ice dessert shows a needle structure having the directivity in the direction to the centre of ice block when the amount of air or other gas contained in the

mix (or, in other words, the so-called "overrun") is not more than 20% by volume.

The reason why has been said to be that ice crystals are quickly produced due to the dipping in a low-temperature refrigerant whereby the directivity in the direction to the centre is resulted. However, the needle-shaped crystal structure having the directivity as such has an unfavourable action that the palatability is greatly deteriorated by that upon eating the ice dessert.

Thus, according to the conventional method, due to the presence of big crystals in ice dessert and particularly of a needle crystal structure therein, a strong resistance is resulted to teeth upon eating and unpleasant palatability usually called as "a tooth-floating feeling" is unavoidable. Such an unpleasant rough palatability of ice crystals is one of the disadvantages in the quality of ice dessert.

On the other hand however, due to fresh savour, cool and refreshing feeling, specific mood for arousing the nostalgia and simplicity of one-hand type inherent to ice dessert, there has been an increasing preference to ice dessert year by year.

Under such circumstances, the present inventor paid his attention to the advantages of ice dessert and achieved the present invention with an object of manufacturing a novel ice dessert having no such an unpleasant palatability inherent to ice lolly and but having a smooth palatability like ice cream whereby the above-mentioned disadvantages are solved.

In order to achieve the above object, the present inventor has conducted a physical/chemical investigation such as selection of starting materials and compounding agents and also a technological investigation such as selection of freezing temperature, brine and manufacturing steps and, as a result, he has found that, when an ice dessert which was once frozen is physically compressed, the aimed object is able to be unexpectedly achieved and, based upon such a new finding, he has continued the study whereupon the present invention has now been accomplished.

Thus, the present invention relates to a method for the manufacture of ice dessert in which the manufactured ice dessert is compressed under high pressure at the end of a conventional machine for the manufacture of ice dessert of a dipping type such as a biter line [*back-transliterated from Japanese alphabets, so the spelling may not be correct – Translator*] so that the ice crystal structure having a directivity to the centre is destructed and then a re-formation into a predetermined shape is done. Thus, in the resulting product, ice in needles having the directivity is destructed and, therefore, it is now possible to manufacture a product having soft texture and body even

at a low-temperature state and having a good taste with fine savour.

In the ice dessert manufactured by the present invention, its palatability is improved and it is soft even at a freezing temperature (−20°C) and has a texture which is able to be crushed with teeth. Thus, it is a novel food where the savour is significantly improved as compared with the conventional ice dessert.

The characteristic feature of the method of the present invention is that a once-manufactured ice dessert is compressed and such a method is able to be applied to all kinds of ice desserts having unpleasant crystals manufactured by conventional methods for the manufacture of ice dessert such as an ice dessert manufacturing method by dipping in refrigerant and a manufacturing method by means of air blast and has a very high applicability. Therefore, when the step of the present invention is attached at the end of the commercially available machines for the manufacture of ice dessert being available in the market under the names of Biter Machine, Foyer Bar Machine and Gram Bar Machine [*all of those three are back-transliterated from Japanese alphabets, so the spellings may not be correct – Translator*], it is now possible to manufacture the ice dessert having the above advantages in large quantities.

Now the method for the manufacture of ice dessert according to the present invention will be illustrated in detail.

Fig. 1 shows a schematic depiction of an ice dessert manufacturing machine of a bar machine type. In a filling step (A) shown in the drawing, a mix is filled in a mix filler (B), hardened by a refrigerant vessel in which a refrigerant is placed and, when the mix is in a semi-hardened state, a stick is inserted thereinto using a stick inserter (C). Inserting depth of the stick does not particularly affect the quality of the product but just a strength which is able to be pulled out upon pulling out the ice block from an ice tube in the next step is held will do. In the case of a product in a size of 90 ml using a common stick of 114 mm, the inserting depth may be not more than 50 mm.

After that, the ice tube in which hardened ice block is present comes out from the refrigerant vessel, surroundings of the ice tube are warmed by warm water or the like in a defrosting step (D) and the ice block is pulled out from the ice tube.

It is necessary that the temperature of the surface of the pulled-out ice block in the compressing step (E) is within a range of from −5°C to −15°C and, for such a purpose, it is recommended that the temperature of the refrigerant at the freezing step is −25°C to −35°C and that the temperature of the warm water for defrosting is 55 to 65°C.

The pulled-out ice block moves to the position just above the compressing step for conducting the method of the present invention under a state of being hung at the pulled-out area.

After that, the hung ice block descends between a pair of compressing moulds 2 by means of utilization of an up-and-down moving gear. The position of the compressing moulds 2 is fixed at the position when the ice block descends to the lowest position and, together with the descending, a pair of compressing moulds 2 are put together to compress the ice block whereby the ice crystal structure is destructed.

The compressing movement and the up-and-down movement of the pulling out part are synchronised. Thus, when the compression finishes, the compressing moulds open to the original positions and, as soon as they open, the pulling out part moves upward and comes to the next position intermittently. At that time, the next ice block comes to the place just above the compressing step and those steps are repeated successively. The compressing step is completed when the pulling-out part stops.

The compressing device will be illustrated in more detail as follows. As shown in Fig. 2, there is a stand 9 for supporting the compressing device and four hydraulic cylinders 6, 7 are fixed thereon. When the ice block descends to the position during the state when the compressing moulds 2 open, the four hydraulic cylinders work at the same time and move two back plates 1 from the reversed directions each other. The back plates 1 move along a guiding cylinder 8. When the compression finishes, the hydraulic cylinders 6, 7 open in reversed directions and the back plate 1 opens as well.

The compressing mould 2 is fixed to the back plate 1 and, in the mould, a main body of a heater 4 for preventing the re-freezing of the ice block after the compression is installed. In the drawing, 5 is a heater plate.

The heater is electrically controlled and adjusts the surface temperature of the compressing mould 2 at 20°C to 60°C.

A stroke between opening and closing of the compressing moulds 2 is adjusted by the hydraulic cylinders 6, 7 and the distance 3 between the two compressing moulds 2 upon closing is, for example, set at not more than 0.5 mm. Further, with regard to the opening and closing time, a timer is installed therein so that the compressing time is able to be adjusted during the stage where the pulling-out part stops.

With regard to the pressure for compressing the ice block, it is necessary to be 50 to 200 kg/cm^2 (per unit area of the ice block) and, when the total solid amount of the mix is small, high pressure is needed while, when the total solid amount thereof is large, compression is possible by low pressure. They also affect the surface temperature of the ice block and,

when the surface temperature is high, compression by low pressure is possible.

Fig. 4 shows the relation between compressing pressure and surface temperature.

Shape of the space 3 formed between the two compressing moulds 2 is not so important for producing the product which is an object of the present invention but may be any shape so far as it has a short texture moving distance for destruction of the ice crystal structure of the ice block, which is a mere base, by means of compression.

To be more specific, any distance will do so far as the ice block texture is able to move to an extent of at least 1 mm in the direction of any of 360°. Actually, since the compression is done by the compressing moulds 2, the ice block moves in the opposite direction of the moulds or in the up-and-down or right-and-left direction.

Further, there is no particular stipulation for the relation between the volume of the space 6 formed between the compressing moulds 2 and the volume of the ice block which is a base. However, when ice block where a part thereof is larger than the space between the moulds is used, it goes without saying that a part of the ice block which is not received in the space falls downward. Since it results in loss of the product, careful attention is to be paid thereto.

On the other hand, when the ice block is smaller, compressed ice block does not fill in the space of the moulds whereby a product having air pockets is manufactured.

Accordingly, it is preferred in general that volumes of ice block and of mould space are nearly equal and, with regard to the shape, it is necessary to be constituted from the part which is smaller than the shape of the ice block and the part which is larger than that within an extent of the distance necessary for moving the texture of ice block for 1 mm.

Fig. 3 is a schematic depiction of a working cycle of the compressing step. An ice block 10 before the compression hanging on a pulling-out conveyer 12 (step I) is fallen down into a moulding space of a mould (step II), hydraulic cylinders 6, 7 are made to work so that the ice block is compressed and needle crystals are destructed (step III), then oil pressure of the cylinder is released to open the compressing moulds and the compressed block 11 is taken out (step IV) whereby a working cycle finishes. The steps are repeated as such so that a compressing treatment in large quantities is carried out.

In the ice dessert prepared by the present invention as such, a needle crystal structure in the central direction obtained by a quick freezing is

destructed and, therefore, the product has more fine and uniform ice crystal structure than an ice dessert prepared by an air blast method. Accordingly, when one eats it, the touch on teeth is good even at low temperature and shearing property upon crushing by teeth is also good.

In the case of the conventional ice dessert having a needle ice crystal structure showing the directivity, it needs a big chewing force upon cutting by teeth due to its directivity of the ice crystals and, in addition, it is sometimes broken at unexpected place along the direction of the ice crystals whereby it often happens that the broken ice falls down from the mouth.

The above-mentioned disadvantages are eliminated in the ice dessert of the present invention.

Thus, when the ice dessert of the present invention is placed in the mouth and is cut off with the teeth, it is able to be cut off with less chewing force than in the case of the conventional ice dessert and the cut direction is not out of the direction to which the teeth are applied. Accordingly, it does not happen that the ice dessert is cracked at an unexpected position and falls down to the outside of the mouth.

In addition, the ice dessert of the present invention exhibits soft texture and body even when it is taken at a low-temperature state and, therefore, the tasty substances compounded therewith such as fruit juice, saccharides and flavour are able to be enjoyed immediately after placing the ice dessert into the mouth whereby there is an advantage that the starting-up of savour is also significantly improved.

Although the compressing step of the present invention is illustrated by referring to the devices mentioned in the drawings, it goes without saying that the present invention is not limited to the method mentioned as such but any other compressing methods may be widely applied.

Example 1

Compounded formulation for ice dessert

Sugar	15.0%	Total solid	18.7%
Malt syrup	3.0%		
V5 concentrated fruit juice	2.0%		
Stabiliser	0.5%		
Colouring agent	a little		
Flavouring agent	a little		
Acidifying agent	a little		
Water was added to make	100.0%		

An ice dessert mix containing fruit juice being compounded as above was heated at 70°C for 15 minutes and cooled down to 5°C. Ice blocks of 90

ml-volume which are the base were prepared from the mix using a bar machine. The ice blocks were compressed and re-formed under the pressure of 100 kg/cm^2 unit area by the already-mentioned compressing step to prepare the product of the present invention. Surface temperature of the ice blocks upon compression was −10°C.

The resulting ice dessert had no needle crystals and showed a very smooth palatability.

Example 2

Compounded formulation for ice dessert

Sugar	15.0%	Total solid	18.7%
Skim milk	4.0%	Non-fat milk solid	3.8%
Plant fat/oil	2.0%	Plant fat	2.0%
Emulsifier	0.1%		
Stabiliser	0.2%		
Colouring agent	a little		
Flavouring agent	a little		

Water was added to make 100.0%

The ice dessert mix having a milky taste being compounded as above was heated at 70°C for 15 minutes, homogenised at the pressure of 150 kg/cm^2 and cooled. Ice blocks of 90 ml-volume which are the base were prepared from the mix using a bar machine. The ice blocks were compressed and re-formed under the pressure of 100 kg/cm^2 unit area according to the already-mentioned compressing step to prepare the product of the present invention. Surface temperature of the ice blocks upon compression was −9°C.

The resulting ice dessert had no needle crystals and showed a smooth and soft mouth-feel. Its savour and palatability were not those of ice dessert but were rather those of ice cream.

Brief Description of the Drawings

Fig. 1 is a schematic depiction showing an apparatus to which a compressing device is attached to an ice dessert manufacturing machine of a bar machine type as an example for conducting the method of the present invention.

Fig. 2 is a plane view of the compressing device.

Fig. 3 is a drawing which shows a working cycle of a compressing step using the above.

Fig. 4 is a graph showing the relation between compressing pressure

and surface temperature in which X shows the case of an ice dessert where the total solid amount is 18% and X [*Y? - Translator*] shows the case of an ice dessert where the total solid amount is 21%.

In the drawings,

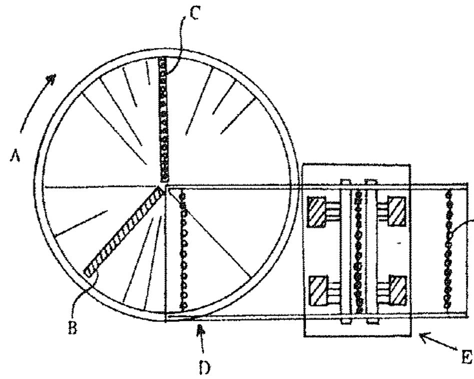
A	filling step
B	filling machine for a mix
C	stick inserter
D	defrosting step
E	compressing device
F	product
2	compressing mould
3	shape-forming space between the moulds
6, 7	hydraulic cylinders
10	ice block before compression
11	ice block after compression

[*Translation of Japanese terms in the drawing*]

Fig. 4

Ordinate:	compressing pressure (kg/cm^2)
Abscissa:	surface temperature (°C)
Last line:	Relation between compressing pressure and surface temperature

第 1 図



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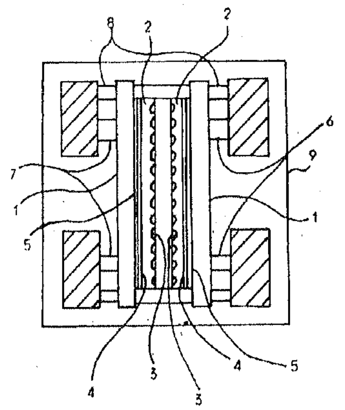

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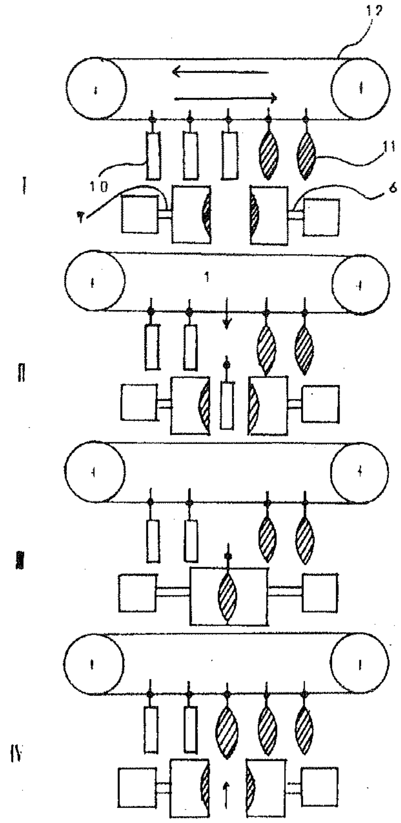
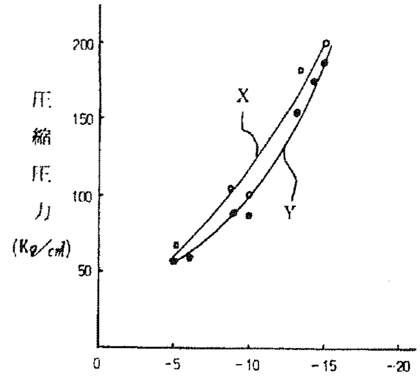


第 4 図



圧縮圧力と表面温度の関係